

SURVEILLANCE BRIEF

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CARBON MONOXIDE POISONING DISPARITIES IN WISCONSIN

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SUMMARY — Carbon monoxide (CO) is an odorless, colorless, poisonous gas emitted by burning fuel that can cause a severe condition called CO poisoning. Deaths from CO poisoning have decreased 7.2% worldwide during 1990–2017; however, unintentional, non-fire-related CO poisoning is still a significant public health concern in the U.S. Some populations are at greater risk of CO poisoning, including those with low income, poor housing conditions, or those living in areas with higher unemployment or in crowded housing. In Wisconsin, age-adjusted emergency department visit and hospitalization rates for CO poisoning have decreased in recent years, with the highest rates reported in Washburn, Menominee, and Oneida counties. Despite the decline in CO poisoning rates, Black and American Indian/Alaskan Native populations continue to experience the greatest burden from CO poisoning.

BACKGROUND

Carbon monoxide (CO) is an odorless, colorless, poisonous gas emitted by vehicles and fossil-fuel powered motors. Other common sources of CO are heaters, furnaces, gas stoves, and other fossil fuel-burning appliances. When there is a high concentration of CO in the air, it binds to red blood cells in the body instead of oxygen and causes CO poisoning. The most common symptoms of CO poisoning are headache, dizziness, weakness, upset stomach, vomiting, chest pain, and confusion.¹ The Centers for

Disease Control and Prevention (CDC) uses a standard case definition of CO poisoning, which includes factors such as carboxyhemoglobin (COHb) levels, age, and smoking status.² COHb level is a result from a laboratory blood test that measures the percentage of CO present in a person's blood. A COHb level that is greater than or equal to 2.5% is an elevated result that is evidence of CO poisoning.

Some factors or characteristics affect the likelihood of seeking medical care

for CO poisoning. People with chronic conditions such as heart disease, cancer, and diabetes, as well as children under 10 years old, older adults, and those living in socioeconomic disadvantaged areas are more likely to go to the emergency department (ED) with CO poisoning.^{3,4}

Carbon monoxide is one of the most common causes of death by poisoning worldwide; however, the number of deaths per year is decreasing. During 1990–2017, global deaths from CO

poisoning decreased by 7.2%.⁵ In the U.S., during 2005–2018, deaths by non-fire, unintentional CO poisoning significantly decreased.⁶

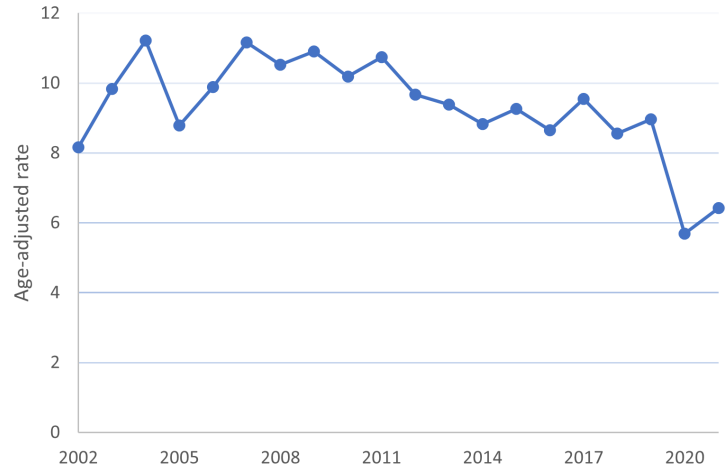
Social determinants of health, such as unsuitable housing, may increase the risk of CO poisoning among historically marginalized populations.⁷ There is no consensus on differences in CO poisoning-related hospital admission rates by sex,^{3,8} but there are clear disparities by race and geographic area. Studies have found higher rates of CO poisoning in rural areas compared to urban areas.^{9,10} Researchers have also found a significant relationship between area-level deprivation (including unemployment, household overcrowding, no car ownership, and depressed socioeconomic status) and increased risk of CO poisoning.³ A study in England found that areas with the highest proportion of Asian or Pacific Islanders had the highest risk compared with areas with the lowest proportion, and areas with more than 21% of people who are Black were 35% more likely to visit an ED for CO poisoning compared to areas where 3.5% or more of people who are Black.³ According to Environmental Public Health Tracking data, during 2012–2021, age-adjusted average annual rates of unintentional CO poisoning ED visits per 100,000 in Wisconsin were 13.1 for Black, 10.9 for American Indian/Alaska Native, 7.4 for White, and 4.5 for Asian/Pacific Islander populations. These disparities may be due to differences in heating practices and levels of awareness of CO sources among racial groups, and language barriers among immigrant populations.^{11,12}

This surveillance brief describes trends in CO poisonings in Wisconsin using ED visit and hospitalization data. Intentional CO poisonings are outside the scope of this brief. Disparities in race, ethnicity, and geographic area are also presented.

TRENDS IN CO POISONING ED VISITS IN WISCONSIN

ED visit rates for CO poisoning in Wisconsin have decreased slightly in recent years, although the COVID-19 pandemic impacted the counts and rates of hospitalizations and emergency department visits in 2020 and 2021. Figure 1 illustrates age-adjusted rates during 2002–2021. ED visit rates peaked in 2004 at 11.2 visits per 100,000 population. The age-adjusted rate was lowest in 2020 at 5.7 per 100,000 population and is likely explained by the reduction in care sought during the COVID-19 pandemic.

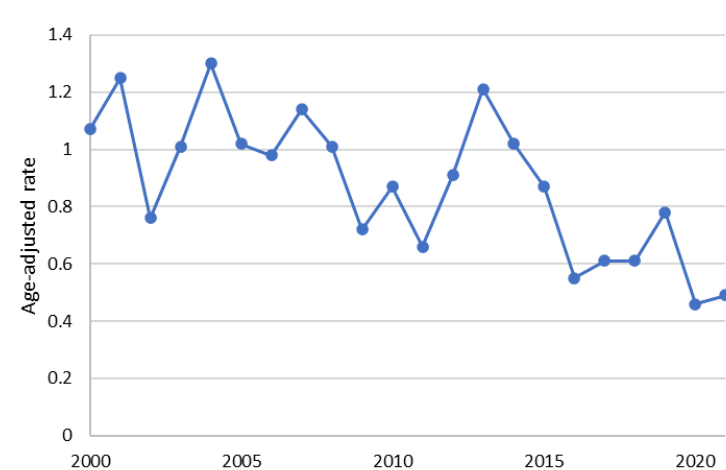
FIGURE 1. Age-adjusted carbon monoxide poisoning emergency department visit rates per 100,000 population, Wisconsin, 2002–2021.



TRENDS IN CO POISONING ED VISITS IN WISCONSIN

Hospitalization rates for CO poisoning in Wisconsin have also decreased over the period 2000–2021, echoing a fall in national rates.¹³ Figure 2 shows the trend of age-adjusted hospitalization rates during 2000–2021, ranging from 0.5 to 1.3 hospitalizations per 100,000 population. In October 2015, coding changes for hospitalization and ED visit data were implemented, which should be considered when interpreting these data.

FIGURE 2. Age-adjusted carbon monoxide poisoning hospitalization rates per 100,000 population, Wisconsin, 2000–2021.



Wisconsin counties with the highest ED visits rates due to CO poisoning during 2017–2021 were Washburn, Menominee, and Oneida Counties, with 85.8, 32.8, and 21.4 per 100,000 population, respectively. In contrast, Florence and Iron Counties did not report any cases, which could be partially explained by the sparse populations in these counties (Figure 3).

RACIAL AND ETHNIC GROUPS IN WISCONSIN

It has been hypothesized that socioeconomic status plays a role in differential exposure to sources of CO, resulting in higher CO poisoning rates among marginalized communities.^{14,15} Historically, communities of color have had the highest poverty rates, with 18.8% and 15.7% for Black and Hispanic populations, respectively, compared with 7.3% for both Asian and non-Hispanic White populations.¹⁶ This suggests that marginalized groups may have less access to safe living conditions, although this is only one potential contributor to the racial/ethnic disparities observed in CO poisoning. During 2017–2021, Black populations had the highest ED visit rates for CO poisoning in Wisconsin, except during 2020, when American Indian/Alaska Native (AI/AN) populations had a rate over three times higher (21.0 per 100,000) than all other populations (Figure 4). The AI/AN rate was higher in 2020 compared to other years due to several multi-person CO exposure incidents among this group that occurred in 2020. Rates for Black people were significantly higher than rates for White people; these differences were statistically significant for all years except 2020. Lowest ED visit rates for CO poisoning occurred most frequently among Asian/Pacific Islander populations.

FIGURE 3. Age-adjusted carbon monoxide poisoning emergency department visit rates (5-year average) per 100,000 population, Wisconsin, 2017–2021.

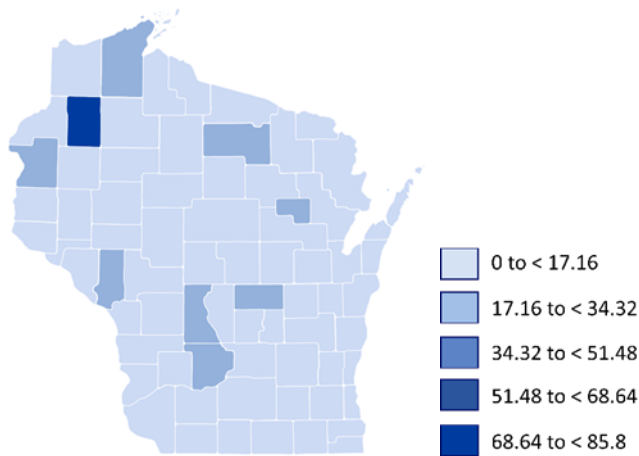
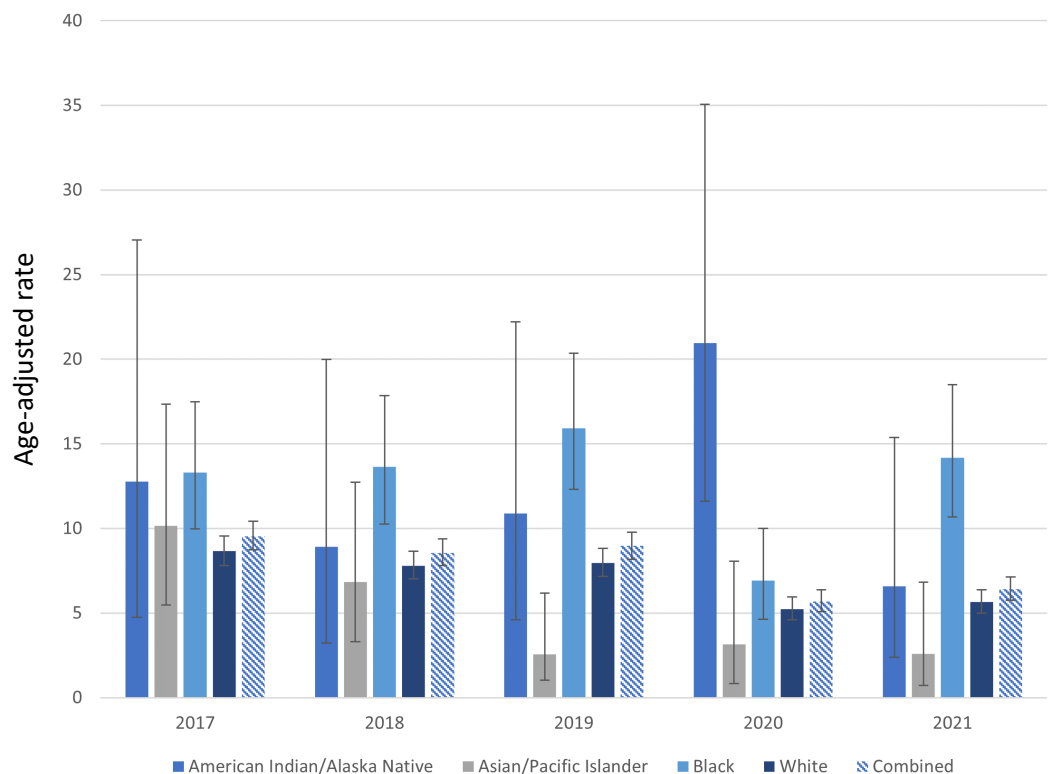
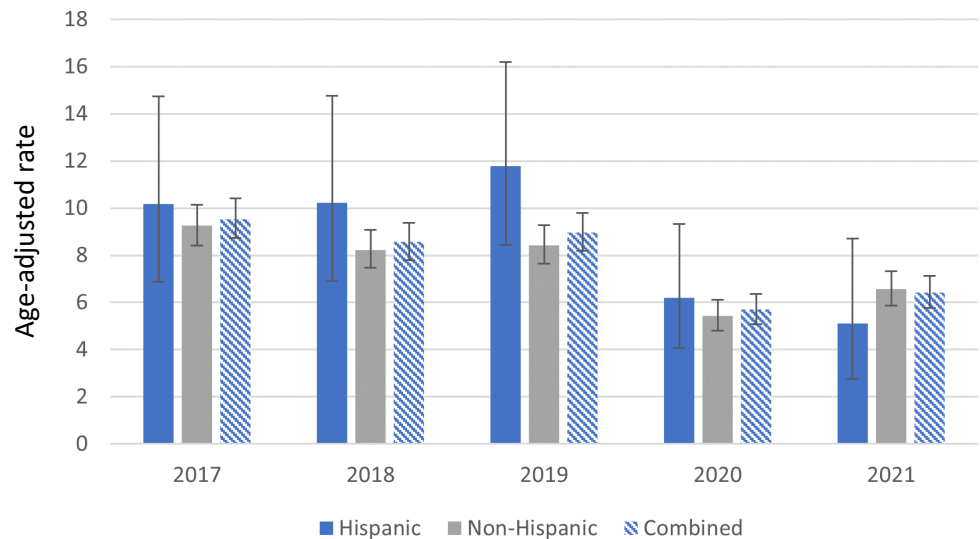


FIGURE 4. Age-adjusted carbon monoxide poisoning emergency department visit rates per 100,000 population by race and year, Wisconsin, 2017–2021.



ED visit rates for CO poisoning decreased for most racial groups in Wisconsin during 2020 and 2021, compared with earlier years, aligning with data presented in Figure 1. The COVID-19 pandemic likely played an important role in this decline, with individuals seeking less health care during this period. Except for during 2021, Hispanic populations had higher rates of CO poisoning compared to non-Hispanics, but these differences were not significant (Figure 5).

FIGURE 5. Age-adjusted carbon monoxide poisoning emergency department visit rates per 100,000 population by ethnicity and year, Wisconsin, 2017–2021.



PREVENTING CO POISONING

There are many ways to protect yourself and others from carbon monoxide and prevent CO poisoning.

For Individuals

- ✓ Replace your CO detectors every five years.¹
- ✓ Replace all batteries in CO detectors twice a year; it's recommended to do this when daylight savings time changes.
- ✓ Have all fuel-burning appliances like furnaces and gas stoves serviced annually.
- ✓ Open your windows while you cook and use exhaust fans that vent to the outdoors.
- ✓ Be careful to clean ventilation systems like chimneys because they can be blocked by debris, especially in cold seasons.
- ✓ Do not start a vehicle in a closed garage.
- ✓ Do not use gasoline-powered generators or tools, charcoal grills, or bonfire pits indoors or in any partially- or fully-enclosed spaces, either at home or at work.



For Policymakers

- ✓ Require building owners to install at least one approved CO detector in each key area.¹⁷
- ✓ Foster collaboration among health and environmental programs.¹⁷
- ✓ Require installation of CO detectors in schools and workplaces.
- ✓ Support increased funding for environmental public health to implement educational and outreach programs to prevent CO poisoning.

CONCLUSIONS

ED visit and hospitalization rates for CO poisoning in Wisconsin appear to be trending downward. However, certain counties such as Washburn, Menominee, and Oneida had high rates of emergency department visits from CO poisoning in the last five years, compared to Wisconsin as a whole. Systemic issues caused by racism adversely impact the socioeconomic status of communities of color, which limit their access to safe housing conditions and lead to disparities in CO poisoning rates by race and ethnicity.¹⁸ During 2017–2021, Black populations had the highest rate of ED visits by CO poisoning. There were no significant differences in CO poisoning rates between Hispanic and non-Hispanic populations during this period. To better address disparities in CO poisoning, it is necessary to improve the alliance between government, community organizations, and health care providers to educate communities about CO poisoning and prevention strategies; work with local health departments to distribute CO detectors to at-risk householders and provide education on proper installation and use; provide technical assistance and resources to health care providers on screening for CO poisoning and reporting cases to public health authorities; develop policies requiring installation of CO detectors in schools and workplaces; and support environmental public health funding to implement CO poisoning prevention work.

CARBON MONOXIDE RESOURCES

Protecting your family from carbon monoxide fact sheet:
<https://www.dhs.wisconsin.gov/publications/p01569.pdf>

Carbon monoxide data for Wisconsin:
<https://www.dhs.wisconsin.gov/epht/co.htm>

Carbon monoxide detectors in residences—information for landlords:
<https://www.dhs.wisconsin.gov/publications/p02936.pdf>

Ice arena best practices:
<https://www.dhs.wisconsin.gov/air/arena.htm>

What employers need to know about CO poisoning:
<https://www.dhs.wisconsin.gov/publications/p02486.pdf>

OSHA's CO guide:
<https://www.osha.gov/sites/default/files/publications/carbonmonoxide-factsheet.pdf>

Using generators safely:
<https://www.dhs.wisconsin.gov/publications/p01561.pdf>

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